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ADSORBENT CLAY

The name "adsorbent clay" is applied to material composed largely of one or more of the montmorillonite group of clay minerals, and which has the capacity to selectively adsorb coloring matter and other impurities from oils. Some adsorbent clays are marketed in nearly their natural state; others are activated by physical or chemical treatment.

The naturally adsorbent clays, called "fuller's earth", ordinarily do not respond to artificial activation; those that do--acid-leached or acid-treated clays--rarely possess natural decolorizing power. However, such clays, upon activation, usually have several times the decolorizing efficiency of fuller's earth. This advantage has led to an increasing use of activated clay instead of fuller's earth, although the former is the more expensive. The clay minerals of the kaolinite group are not color adsorbent either in their natural state or after any of the known methods of treatment. Materials other than clay are also used as color adsorbents. These include bauxite, bone char, and activated carbon.

The petroleum industry consumes about 90 percent of the total output of adsorbent clay and employs it in many ways. Especially significant are the uses of clay in 1) decolorizing and removing gums from gasoline and lighter petroleum fractions, 2) decolorizing and removal of acid sludges from lubricating oils, 3) decolorizing of paraffin and microcrystalline waxes, and 4) catalytic cracking of gasoline. Significant quantities of clay are also used in decolorizing various vegetable and animal oils.

The use of fuller's earth for its adsorbent properties dates from ancient times. The material is noted in the Bible and in the writings of Pliny; it was used by the Chinese more than 1000 years ago. It was mined in England as early as the mid-1800's and first shipped to the United States in 1880. In 1891 a fuller's earth deposit of commercial significance was discovered in Arkansas and within a few years extensive deposits were developed in Georgia and Florida. More recently deposits have been found in California and several other states.

Activated clays were first prepared in 1905 by the Germans and were extensively used by them during World War I when importations from England were shut off. Activated clays came into widespread use in the United States also during World War I.

The oil industries now employ adsorbent clays in two principal ways - the percolation method and the contact method. Both methods effect an intimate contact between oil and clay. In the percolation method the oil is allowed to percolate through columns that contain closely sized granules of clay. The contact method involves the direct addition of powdered clay to the oil which is then agitated and filtered. For both methods contacting is done with the oil at an elevated temperature. Both methods are extensively employed by the petroleum industry. Fatty oils are treated only by the contact method.

Because adsorbent clays vary widely in appearance, their decolorizing efficiency and adsorptive capacity cannot be safely predicted by inspection in the field. As mined, most of them contain over 50 percent free moisture, have a soapy feel, and can be cut with a knife. Shavings, particularly those of activable bentonites, are generally translucent. Dried fuller's earth tends to adhere to the tongue, a property much less pronounced in activable clays. In water neither type swells appreciably; activable bentonite will slack but fuller's earth will not.

The minerals of the montmorillonite group are essentially hydrous silicates containing aluminum, magnesium, calcium and iron in various proportions and combinations. Adsorbent clays ordinarily have an alumina-silica ratio in the general range of 1:2 to 1:8 as contrasted with a lower silica ratio for kaolin. In some clays a higher ratio may be indicative of good adsorptive capacity.

When crushing or grinding adsorbent clays, the particle size distribution must be closely controlled